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## BIOGRAPHY.

DR. PERCIVAL FROST.

BY DR. GEORGE BRUCE HALSTED.

**P**ERCIVAL FROST made one in that Cambridge paradox, Second Wranglers greater than their Seniors.

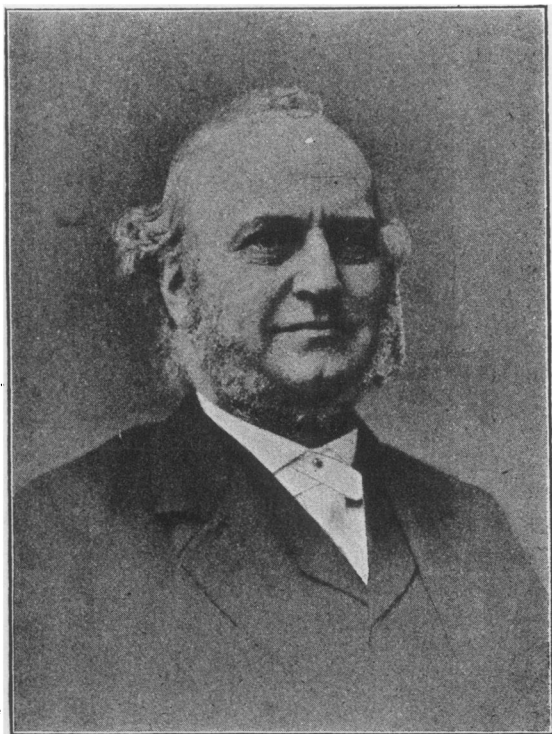
In 1837 the great Sylvester was second to Wm. N. Griffin, both of St. John's College; in 1839 Frost was second to B. M. Cowie, where the first four places in the Mathematical Tripos were all won by men of St. John's College. Of other great seconds we recall Dr. Whewell, Clerk Maxwell, Lord Kelvin, Clifford, J. J. Thomson, truly a goodly company!

But Frost was First Smith's Prizeman, a contest at which nearly all these great seconds beat their firsts, though Sylvester, being unwilling to sign the Thirty-nine Articles, was debarred from entering this competition.

Percival Frost, second son of Charles Frost, F. S. A., a solicitor practicing in the town of Kingston-upon-Hull, was there born on September 1, 1817. He died June 5, 1898. Frost's earlier schooling was at Beverley, whence in 1833 he went to Oakham School, remaining until October, 1835, when he entered St. John's College, Cambridge.

The Senior and Second Wrangler in 1839 were both elected to fellowships in their College on the same day, March 18th, 1839.

Frost illustrated another Cambridge peculiarity, great men choosing as a career to Tutor to private pupils, for example Hopkins, Frost, Routh. It is



DR. PERCIVAL FROST.

especially mentioned in the notice of him written for the Royal Society by his friend H. M. Taylor that his great success in obtaining private pupils when he returned to Cambridge in the Long Vacation succeeding his graduation induced him to abandon all idea of the legal profession, though urged by friends to read for the Bar, which indeed he had actually commenced to do. So settled and confident was he in this Cambridge profession of Private Tutor, that in 1841 he vacated his fellowship to marry Jennett Louise Dixon, of Oak Lodge, Finchley, with whom he "lived happy ever after" for 57 years !

Frost held a mathematical lectureship from 1847 to 1859 in Jesus College, from 1859 to 1889 in King's College ; but his chief work still consisted in the tuition of private pupils. As Frost himself was pupil of a Second Wrangler, Dr. John Hymers (1826), so his own greatest pupil was a Second Wrangler, W. K. Clifford, in 1867.

Frost edited Newton's *Principia*, Book I, sections 1—3, with notes, illustrations, and a collection of problems. First published in 1854, new editions appeared in 1863, 1878, and 1883. In 1863, with Joseph Wolstenholme, the noted problem maker, Frost published 'A Treatise on Solid Geometry.' When it was to be reissued, Wolstenholme withdrew, and the second edition 1875 and third edition 1886 were published by Frost alone, as also 'Hints for Solution of Problems in the Third Edition of Solid Geometry' in 1887. On this essential subject, this is one of the two great standard works in English.

In 1872 he published his famous 'Treatise on Curve-tracing.' In this treatise he presumed on the part of the reader no knowledge of the Differential Calculus, and restricted his field in other wise ways, until he humorously says, "In cutting off so many vital parts of a complete treatise I have to shew that I do not fall to the ground by sawing on the wrong side the branch on which I am sitting." In using the device of the Analytical Triangle, adopting Cramer's method of representing the possible terms by points, Frost was the first one to regard them merely as points referred to the sides of the triangle as coördinate axes, instead of regarding them with Cramer as marking the centers of the squares in which, in Newton's parallelogram, the values of the terms were to be inscribed.

This treatise cannot be too highly praised, and is still likely long to remain the greatest on the subject.

More than twenty papers by Frost on Algebra, Analytic Geometry, Lunar and Planetary Theories, and Electricity and Magnetism are mentioned in the Royal Society's 'Catalogue of Scientific Papers.'

Frost was made a Fellow of the Royal Society in 1882, and the same year was elected by King's College, Cambridge, to a terminable Fellowship, to which he was re-elected three times, holding it at his death. Like Sylvester, Frost was devoted to music with a fine execution on the piano and a penetrating appreciation of the masters.

Think of a man living 80 years scarcely knowing a day's illness ! This seems to an American as if he had never really tried his powers to the utmost.

Frost was, as R. Tucker writes, a great favorite at Cambridge, a sure concomitant of his brightness, cheerfulness, kindness of heart and consideration for others.

His exceptional life-long experience gives tremendous weight to his testimony in favor of the early cultivation of a talent for mathematics.

He explicitly says : "To attempt after a certain age to acquire ease in mathematical operations is like a grown man trying to learn the violin."

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## SOME REMINISCENCES IN REGARD TO SOPHUS LIE.

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By DR. G. A. MILLER.

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Since the death of the famous Norwegian mathematician, Sophus Lie, a large number of appreciative articles on his life and work have appeared in the mathematical journals of various countries. Two such articles were published in the April number of this journal. In what follows we shall endeavor to add a few details (based upon personal observations) which may assist those who never met him to form a more accurate idea with respect to him.

The trait of Lie's character which impressed me most forcibly when I first met him in the summer of 1895 was his extreme openness and lack of effort to hide ignorance on any subject. It is well known that he began the study of discontinuous groups under the masterly guidance of Sylow. He maintained a deep interest in these groups, making frequent use of Jordan's classical "*Traité des Substitutions*," and he spoke in terms of great respect of the work of Jordan, Frobenius, and others who were working in the field of discontinuous groups.

He, however, never felt at home in this subject. In fact he frequently remarked during his lectures that he always got stuck when he entered upon the subject of discontinuous groups, To him the continuous groups seemed more simple as well as more useful. He frequently used the expression, "the discontinuous groups are good but my (continuous) groups are better," and he advised his students to begin their study of groups with the continuous groups and to take up the study of the discontinuous groups later.

He was an inspiring teacher but his lectures were not always well prepared. Sometimes he had to pay quite heavily for this lack of preparation, being unable at the moment to prove simple things in his own theory. It was an interesting sight to see him at the board working away with all his might and calling on his students to help him out of the difficulty, using the expression, "Here I stick, will not one of you help me out." He kept in good spirits at such occasions but he generally could not maintain enough self-possession to work his way out of the difficulties during the rest of the hour.

He was somewhat careless in regard to his dress. If he felt uncomfort-